SYSTEM FOR CONTROLLING SEPTUM DAMAGE

FIELD OF THE INVENTION

The present invention relates generally to a system for locating a vial with a penetrable septum in a predetermined position with respect to a plurality of needles which penetrate the septum at periodic intervals.

DESCRIPTION OF THE PRIOR ART

In commercial equipment which requires penetration of a septum, such as for gas chromatography, it is customary to introduce a sample of gas or liquid through the septum by injecting the sample through a hollow needle which penetrates the elastomeric septum. To prevent septum damage from causing leakage after a few tests, a guide is used which locates the needle in a position to enter the septum very nearly at the center of the circular septum. The result is that on each test after the first, the needle re-enters the cut or tear made by the needle on the first test and produces little additional damage. Thus, a great many tests can be made using a single septum, even though the needle is inserted manually.

Other commercial automated equipment requiring repetitive entry through a septum utilizes two or more hollow needles. An example of such type of commercial instrument is described in U.S. Pat. No. 3,676,679 to Waters. Such systems require repeated tests of the contents of a vial through the use of a plurality of hollow needles, usually two, to penetrate an elastomeric septum sealing the vial. The use of two needles permits a large volume of sample to be withdrawn rapidly and with controlled dilution but without any permanent reduction of pressure within the vial. Such vials may be under a slight positive pressure due to the growth of microrganisms. While one needle withdraws gas for analysis, the second needle admits gas to replace that withdrawn, restoring approximately the original pressure.

At each penetration, each needle produces a small cut or tear in the septum. Accidental rotation of the vial between successive tests soon produces an uncontrolled distribution of spetum damage. Since more than one needle is being used, it is not possible to provide a needle guide for insertion of the needle at the approximate center of the septum. The result is that when adjacent locations of septum damage happen to overlap, or to be too closely spaced, the functionality of the septum is destroyed. This limits the number of tests which can be made before septum failure is likely to occur. Furthermore, no definite number of tests can be made without loss of septum efficiency and it is possible that the septum will be destroyed prior to a single passage through automated testing equipment which requires repeated testings of a vial during the passage.

SUMMARY

The present invention provides a system for locating a vial with a penetrable septum in a predetermined position with respect to at least one needle which penetrate the septum at periodic intervals.

In general, the system includes a vial carrier containing a well, a vial having a cross sectional shape which permits insertion in the well, and locating means within the vial carrier for establishing a predetermined location for the vial in relation to at least one, and usually a plurality of needle(s) which penetrate a septum in the vial at periodic intervals. The locating means includes a plurality of contact points and urging means for establishing contact between the contact points and a locating surface.

For purposes of discussion, a vial is generally considered to include a body portion (which in most prior art applications is cylindrical) an opening in the top of the vial, a septum located in the opening and a seal surrounding the septum and the opening. The portion of the vial which consists of a gradual reduction in cross section to form a neck containing the opening is generally referred to as the finish of the vial.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of a vial located in a vial carrier in accordance with the invention;

FIG. 2 is a cross section taken through A—A′ of FIG. 1;

FIG. 3 is a cross sectional view taken through section B—B′ of FIG. 1; and

FIG. 4 is a top plan view of a further embodiment of the vial and vial carrier in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The system of the present invention is adapted for use with prior art automated equipment wherein a test head captures the finish of a vial and holds it in a definite location with respect to needles which penetrate the septum. Thus, if rotation of the vial is prevented between successive penetrations of the septum, the needles will penetrate the septum in the same position as the last penetration. Of course, if the needles are changed between successive penetrations of the septum, the new needles must be positioned in the same location as the previous set of needles to permit penetration of the septum in the same position.

In a preferred embodiment of the present invention, the body of the vial has a cross sectional shape which is such that it fits into a vial carrier in such a manner as to prevent rotation of the vial about a vertical axis. Each needle in the needle set is then constrained to enter the septum at a definite location and will do so on repeated penetrations of the septum.

In a system where the vial remains in the same vial carrier throughout all testing, the cross section of the vial might, for example, be in the shape of a circle, an equilateral triangle, an isosceles triangle, an irregular triangle or an isosceles trapezoid. A spring or other elastomeric object is used to press against one side of the vial to restrain the vial in a fixed predetermined position within the vial carrier.

In some situations, it is preferred to use a system in which the vial can be placed in the vial carrier only in a unique orientation. For example, a vial in the shape of an equilateral triangle could be replaced incorrectly if the vial was removed between tests. In addition, the vial might carry a machine readable label which would need to be in a particular location to be read. For these occasions, the body of the vial would preferably have an irregular shape, such as the cross sectional shape of an isosceles triangle or an isosceles trapezoid. The well in the vial carrier would be of a similar shape only a little larger so that the vial could be inserted only in a matching orientation. The vial would be urged by a spring into one vertex of the opening to prevent the vial from rotating about a vertical axis. In practice, it is possible to